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THE PSYCHOLOGICAL ANALYSIS AND PHYSICAL BASIS OF PLEASURE AND PAIN.[1]

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IN the report of a recent meeting of the Neurological Society, I notice as part of a discussion on the nature of pain the following statements: "Psychologists seemed to have come to the conclusion that pain was not a sensation, but a form of feeling; that it was not to be classed with sensations of touch, or of temperature, or of heat; that it did not have peripheral end-organs, and that there were no nerves in existence which on irritation produced pain alone; that in attempting to locate such a tract we were pursuing a will-of-the-wisp. Pain was not a special sensation, but a modification of it. We might have a painful wound, but we did not have a simple sensation of pain; it was always combined with something else."

These statements seemed to me so remarkable, that in preparing a paper on the nature of pleasure and pain to read before a body of neurologists, I felt that I could not avoid a direct reference to them. They are noteworthy in the first place as indicative of the willingness of a neurologist to accept as conclusive the results of mental analysis and to extend the validity and application of such results over a class of facts not altogether germane to the science of psychology. In the second place, they demand some consideration by way of modification, because of their somewhat exaggerated estimate of the status among psychologists of the so-called "quale-theory," as to the nature of pleasure and pain—the theory which, in Dr. Dana's words, considers "pain not a sensation, but a form of feeling." Modern psychologists cannot be said in any sense of the word to have come to accept the quale-doctrine as an explanation of pleasure and pain phenomena. This theory is a bit of psychological drift-wood that has been thrown before the feet of the modern psychologist by the waves of past speculations. From Aristotle to Mr. Marshall, the theory has been presented in many forms. Numberless attempts have from time to time been made to explain the physical basis of pleasure and pain from the point of view of the quale-doctrine, but as Mr. Marshall so clearly shows in his admirable restatement of the doctrine, they all fail of the essentials of a satisfactory explanation. Even his own physiological interpretation would succumb before Mr. Marshall's critical analysis. In common with those that precede it, it does not explain, but only restates the facts, coupled with some observations of very general and somewhat superficial nature as to the relations between pleasure and pain states and certain physiological processes of the human body.

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[1] Read before the Neurological Section of the Academy of Medicine, February 16, 1894.

It is the purpose of this paper: 1. To consider critically the psychological basis of the quale-theory. 2. To put before you the physiological explanation of pleasure and pain phenomena as given by Mr. Marshall[2] in what is the latest and clearest formulation of this doctrine. 3. To show that modern psychologists are not at all agreed as to the necessity of explaining pleasure and pain by reference to the quale-doctrine.

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[2] It is earnestly hoped by the author of this paper that none of his remarks may through some inadvertent mode of expression be taken as directed personally against Mr. Marshall. The writer does not presume to think that anything he can say will lessen the esteem in which Mr. Marshall's work is held. The stand taken is against the conclusiveness

Of the various mental phenomena to which we give the name of pleasure or of pain, I wish to call your attention to: 1. Pains that are of simple, vivid and distinctive character and that may be exactly localized—such as the pain of a severe burn, the prick of a pin, the pain of neuralgia.

2. The pleasures concomitant and associated with the exercise of the function of reproduction. Pleasures and pains are so intimately connected in common thought and in psychological treatment that both states must be considered in an explanation of either one. The pleasures of sex are here emphasized as the only pleasures that approach in distinctness, definiteness, intensity and apparent simpleness of character the extreme states of pain mentioned above.

3. Those more indefinite and for the most part not very intense pleasures and pains that are a constituent part of many mental states—the agreeableness or disagreeableness of an emotion or a sensation; the agreeableness of a piece of music, or of the taste of sugar; the disagreeableness of a sensation of cold.

It is the peculiar task of the psychologist to examine these states of extreme pain, of extreme pleasure, of agreeableness and disagreeableness, to inquire whether they be like or unlike, simple or complex, and to discover their relations to other phenomena of consciousness.

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of the argument for the quale-theory and the possibility of any physiological interpretation of it in the present state of physiological speculation. Mr. Marshall's formulation has been selected because of its modernity and completeness, and also because of the *ex cathedra* utterances in which it has been presented to New York neurologists. The theory as here presented appears in *Mind*, Vols. xv and xvi. See also *Philosophical Review*, Vol i., No. 6., JOURNAL OF NERVOUS AND MENTAL DISEASE. February 1893, and the volume that has just appeared "Pain Pleasure, and Æsthetics."

The quale-theory maintains that all states of pleasure and pain are included in a single series or continuum, passing from intense pleasure through agreeableness, indifference and disagreeableness, to extreme pain, and that all the several varieties of pleasure and of pain are but phases or aspects of one and the same mental element.

In the words of Mr. Marshall, "pleasure and pain are two states which are too disparate to be commonly known by any one word, but so inseparably connected that they must be mentioned in one breath." "The ground for this lies in the fact that the two appear to arise in consciousness as disparate parts of a continuum. One fades away into the other. Strong stimuli, if continuous, gradually fail in the production of pleasureableness, and as gradually become pain-producers. This community of character should seemingly lead us, at least, to hold that where we class the one there we must class the other also. We cannot, with propriety, say, for instance, that pleasure is to be classed with sensation, and then that pleasure is an emotion, holding sensation and emotion to be diverse in character."

To emphasize this essential unity of pleasure and pain phenomena, and to facilitate the "mentioning in one breath" of the two phases of this single state of consciousness, Mr. Marshall proposes the word *pleasure-pain.* Pleasure-pain is a simple element—nay, if we may use language so, even less than an element,—a quality, an attribute, whose various phases, in Mr. Marshall's words, must be considered, "as primary quales which affect *all* presentation however wide, however narrow, somewhat after the manner in which we grasp the notion of intensity as being common to all presentation." Pleasure-pain is the feeling-tone of German psychology, with this implied, if not distinctly emphasized, difference, that whereas feeling-tone embraces the agreeable and disagreeable elements in all sensation, but is discreetly silent as to the extremes of pleasure and pain, the word pleasure-pain emphasizes the opinion of the quale-theorist that this single phenomenon or quale of the mental element includes among its phases both extremes. The theory requires that, under favorable conditions as to intensity, every sensation or mental state whatever may be presented in the extreme of pleasure, in the extreme of pain, and in any pleasure or pain intensity between these and indifference. It requires that quinine in proper intensity should give a pleasure equal in intensity to that of the exercise of the sexual function; that the odor of violets in sufficient intensity, should give a pain as decided and intense as the agony of angina pectoris. Further, it insists that no pain ever comes into consciousness except as a constituent part of some sensation or emotion; that we never experience pain except as an attribute or quality of a touch, or of a color, or of some other specific sensation-content.

The peculiarly psychological problem here, as Mr. Marshall insists, is one of classification. What is the proper basis of scientific classification in psychology, and what is the nature of the considerations that induce Mr. Marshall to decide that pleasures and pains cannot be classified with any other group of mental phenomena? In my opinion, we may distinguish Mr. Marshall's classification as psycho-physical rather than psychological. This distinction, which seems to me an important one to keep in mind, if we are to distinguish clearly between the data of introspection and the inferences of psycho-physical observation, is significant for every department of psychology. Without delaying to examine the requirements of a scientific classification, almost unconsciously in fact, psychology takes for granted that the proper basis of mental classification is to be found by reference to the different physical and physiological conditions that are supposed to determine the presence of the phenomena in consciousness. The traditional classification of all mental phenomena into states of cognition, feeling and volition, is at bottom a psycho-physical one; as the basis of this classification are taken certain differences in the relations subsisting between a mind and the external physical world. The class of cognitive states, to which belong my perception of this room and my recognition of a face in the audience, is not determined in the last resort by an observable likeness among perceptions as mental phenomena, but by the fact that in perception, the mind and the external object are in a relation such that the mind knows the object. The class of volitions or states of willing is not determined by these states as such, but by the results which these states are observed to bring about in certain external objects, the muscles of the body. Further, the classification of sensations into five groups, or any number of groups, is a psycho-physiological one, whose basis is the mediation of a sensation group through the same sense organ. Blue and red are classed together as visual sensations, not so much because they seem alike as because we know that both are given to us by the eye. Sensations of heat and cold are classed as similars in a single group of temperature sensations, because we suppose both to be mediated through the same bodily structure, the skin, or because we observe that the same external object may be the excitant of both heat and cold sensations. It is in point, that psychology never ceased to consider all sensations arising from stimulation of the skin as one group, namely, the so-called sensations of feeling, until histology revealed disparate peripheral terminals.

Mental classification is given a purely psychological basis, only when the grouping of phenomena is determined by mental likeness and unlikeness as disclosed by introspection. A confusion of the psycho-physical and psychological standpoints has resulted in a want of clearness in the treatment of many problems of physiological psychology, and is directly responsible for a number of erroneous conclusions. It is an improper inference, for example, that two sensations are alike in mental quality, because we refer them to the same external stimulus or because they seem to come to us through the same sensory end-organs.

It is a similar confusion that lends force to the argument of the quale theory, and for that reason the separation of the two standpoints has been insisted upon in this paper. It seemed desirable, also, to raise some pro test against the assumption by the psychologist of a tone of authority toward the neurologist, when the former's conclusions are the result of psycho-physical and not purely phsychological observation. The field of physiological psychology is common to psychologist and physiologist on equal terms. The modern psychologist finds it necessary to have recourse to the most recent conceptions of the most scientific physiology. Physiological psychology is not distinguished from the older pychology by its psycho-physical standpoint. This is common to both old and modern psychology. The advance made by physiological psychology consists largely in the replacing of popular physiological and physical conceptions by others derived from exact scientific investigation.

Introspection reveals to us mental phenomena differing in degree of complexity. Complex mental states may be resolved into relatively simpler. As the ultimate of introspection analysis, we obtain the irreducible unit of consciousness, the mental element, which is generally called a sensation. This use of the term sensation is not to be confused with sensation as the mental resultant of the excitation of a peripheral sense-organ. The former is a psychological unit, the latter is a psycho-physical one. Whether a sensation, or mental element, can, in every case, be shown to be identical with sensation as the product of sensory stimulation, is one of the problems of physiological psychology.

When, therefore, Mr. Marshall insists that a pleasure or a pain is not to be classed as emotion, nor as intellect, nor as will, although pleasure-pain phases accompany all these states, he is saying, in effect, that these states are complexes, and that pleasure or pain is one of the component elements—an entirely unobjectionable statement of fact. But when, under the requirements of the quale-doctrine, pleasure and pain are classed together as similar phenomena, some violence would seem to be done the facts of introspection. A pain seems as unlike a pleasure as a sound is unlike a color. That pleasure and pain must be "mentioned in one breath" is no disproof of their disparateness as conscious experiences. It is, at the most, an evidence of their intimate association, perhaps through the contrasts they present, as the mental antecedents of bodily movements, or through a similarity of relation to some other extraneous phenomena. The psycho-physical consideration, that pleasure passes gradually into pain with increasing intensities of the same external stimulus, does not prove mental identity. In words taken from a recent contribution of Dr. Nichols on this question, which will be considered below, "the same air wave may cause a sound, a cold creep, a feeling of jar, of tickle, of teeth on edge." Identity of the external stimulus does not prove even a mediation through the same sense-organ. Goldscheider has demonstrated the existence of separate terminal organs for heat and cold stimuli. The end-organ for heat will give a sensataion of heat, and nothing else, no matter how stimulated; a cold spot touched with a hot object will give a sensation of cold, or no sensation at all. The grouping of heat and cold sensations under the name of temperature sensations has neither a psychological nor a physiological significance. Its import is a psycho-physical one, suggesting the possibility of the formation of a group of sensations, dissimilar for consciousness, where only basis of likeness is a common reference to the same external stimulus.

Passing from these considerations of a general nature to the specific arguments of the quale-theory, we find nothing that on nearer examination seems conclusive as to the impropriety of a classification of pleasure and pain with sensations in either sense of that term. We may, indeed, agree for purposes of argument that "none of the typical sensations have the character which we have found in pleasure-pain of being roused by the widest range of psychic occurrences," that "on the contrary, each has a very special means of production by which it and it only is brought into consciousness;" that "pleasure and pain are primitive qualities which may accompany any psychosis"—and yet not be forced into accepting the quale-theory. If every sensation-content (as blue, or sweet) is accompanied invariably by some phase of pleasure-pain, it does not make pleasure-pain a quale or attribute of the sensation-content. It serves only to point out the complex nature of the phenomenon that we have been dealing with. The term sensation, whether with propriety or not will not be considered here, has been used to designate a complex of a sensation-element (such as hot, touch, blue, etc.), and a pleasure or pain element. That a pleasure or pain element accompanies invariably other specific sensation elements is a fact needing explanation, but presenting no very considerable psychological or physiological difficulties. But the facts as well as the argument may be questioned. It is doubtful if the best trained observer can discover introspectively that every sensation is accompanied by either pleasure or pain, or may be accompanied by both. Is quinine ever pleasing to the taste, or the color blue, as an isolated element, painful?

Nor is it a sufficiently conclusive demonstration of the non-sensational character of pleasure and pain that "under continuation of conditions, sensations do not habitually change from one form to another, as pleasure fades into pain." A proper caution in avoiding an overstatement of the facts of observation admits of no wider generalization than that some pleasures often fade into pain under continuation of physical conditions. Further, the inferences drawn from the facts are questionable. Even though certain physical stimuli of constant intensity may arouse a pleasure that under prolonged application of the stimulus fades off into pain, still no demonstration is afforded thereby that the peripheral physiological conditions have remained the same. The physiological stimulus has been ignored as a source of sensation distinct from the physical stimulus. The sensation of muscular fatigue is, perhaps, not the mental correlate of an expenditure of energy in the motor cells of the cerebral cortex, but the resultant of an afferent sensory impulse peripherally excited by the accumulated products of contraction. Is it not a doubtful assumption that the nervous impulse travelling up the optic nerve as the result of prolonged stimulation of the retina by an ether wave of constant length and amplitude remains also constant; and, even if the sensory area of the cortex should continue to receive a constant afferent impulse, has it been demonstrated that there may not be added little by little to the central excitation, directly and reflexly excited elements which eventually change the feeling-tone from agreeableness to disagreeableness?

Equally inconclusive is also the observation that "an increase of the intensity of a stimulus often at first increases a pleasure, then decreases it, then produces an increasing painfulness: a series of which we find no counterpart in sensational experience." This relation between pleasure-pain and the intensity of the stimulus is to be observed with only a most limited number of stimuli; and the relation is not unique, for almost the exact counterpart is met with in the heat and cold series of sensations as related to the intensity of the temperature stimulus.

It is true enough that "sensations are connected with the action of distinctive organs acting in relation to the environment" and that "nothing else than a preconception of the sensational nature of pleasure-pain can lead one on the evidence thus far obtained to a decided opinion in favor of special pleasure-pain organs." Physiology does not suggest a pleasure-pain organ, but Goldscheider, Edinger and other investigators have reported the discovery of an organ of pain. Though we have had no suggestion as yet of an organ of pleasure, yet it is to be remembered that it is not many years since physiology, then in its infancy, prattled of the tongue as the sense organ for taste, and of the skin as the sense organ for feeling, including temperature, touch, and pain. It is only the most recent research that points to disparate end-organs for sweet, for sour, for bitter, for heat, for cold, for touch. The discovery of a specialized sensory nerve of pleasure with a localized cerebral center, unlooked for as it is, would not be out of line with the discoveries of the past few years.

A conservative opinion based primarily upon the results of mental analysis, but having due regard to physiological evidence of a general nature, would seem justified in maintaining the following propositions:

1. Pain is presented in consciousness with the distinctness, the definiteness, the vividness, and the isolation that are supposed to characterize all sensations. I need not rehearse the list of psychologists, among the number many modified quale-theorists, that give support to the theory of the sensational character of pain. The results of physiological experimentation and the facts of pathology seem to support it. The phenomena of analgesia, which resist all explanation on the quale basis, have not been even considered, much less disposed of by Mr. Marshall in the following inadequate summary. "The capacity to experience one form of sensation in a part of the body may be cut off together with pain without cutting off in the same parts the capacity to experience other sensations (*e. g.*, those of heat) with their capacity for pain." [3]

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[3] The symptoms of syringomyelia, the action of cocaine and other anæsthetics, the phenomena of hypnotism, all present cases of the absence of pain without an entire loss of any other form of sensation—an impossible condition on the quale hypothesis. An interesting case in point was that of a student at the University of Pennsylvania, who was partially susceptible to hypnotic suggestion. His muscular system was entirely under the operator's control, but his sensory system not at all—with the single exception of pain. If told he would not feel the prick of a needle, he would nevertheless be able to do so, and could locate the part touched accurately, but he felt no pain even though the needle were thrust deeply through the skin. This observation was made by Professor Fullerton and myself independently and was verified in a number of trials. It would seem to demonstrate the independence of pain as a conscious content and to suggest a closer connection between motor and pain phenomena than between the former and sensations proper.

2. Pleasure is a mental phenomenon as distinct from pain as heat is from cold, or a sound from a color. The clearness and vividness and simplicity of sensation is not so marked in pleasures as in pains. Neither the complex nor simple character of pleasure can be readily demonstrated.

3. It may with reservations be maintained that agreeableness and disagreeableness accompany every mental state ; but these are given in consciousness not as phases of a dependent quale or attribute, but as simultaneously presented elements.

This conservative summary of the results of the mental analysis of pleasure and pain phenomena might serve as the point of departure for a number of divergent speculations as to the physical basis of pleasure and pain. It is proposed in the second part of this paper to outline briefly two hypotheses with which this summary is in substantial accord, and to contrast these with the account of the accompanying physiological processes given us from the standpoint of the quale doctrine. The first of these is the recent contribution of Professor Münsterberg on "Agreeableness and Disagreeableness."[4] From the results of certain experiments made only upon himself, and therefore, to be accepted as yet tentatively, Münsterberg finds evidence that all pleasurable states of consciousness are accompanied by bodily movements of extension, and all painful states by movements of flexion. These movements may be very slight and need not be referred to the extremities only, although his own experiments were confined to movements of the upper limb. Münsterberg's conclusion is that the feeling of agreeableness is the mental accompaniment of reflexly produced movements of extension, and the feeling of disagreeableness, of reflexly produced movements of flexion. A stimulus, such as a very hot object, through the medium of an afferent nerve impulse, excites certain areas of the central nervous system concomitant with which is a sensation of heat; the central excitation either in the cortex or in centres lower down, reflexly produces innervation of the musculature involved in flexion, which in turn serves as a stimulus for a secondary afferent impulse, producing a cortical excitation whose mental accompaniment are sensations of movement. These sensations of movement are the feeling of disagreeableness. Analogously, the sensations of reflexly excited movements of extension are the feeling of agreeableness. Flexion and extension are not caused by the disagreeable or agreeable element, but the reflexly produced flexions and extensions are the conditions of those conscious processes which we call agreeableness and disagreeableness. The most common objection to this theory, that it makes extension pleasing, and flexion painful, is disposed of by pointing out the essential psychological difference between the sensational product of the movement and the perception of the movement. The movement, as a conscious content, is not necessarily either pleasing or painful. This is a definitely localized perception and is itself dependent upon the same conditions, as a color or a sound, for its feeling tone of agreeableness and disagreeableness. These conditions are to found in the intensity and duration of the primary ingoing impulse. "The Ritter-Rollett discovery, which in an unexpectedly extended form, has recently been firmly established by Osswald, demonstrated that from the same motor nerve root, electrical, chemical, mechanical and thermal stimuli may, according to the intensity and duration of the stimulation, produce movements of either flexion or extension. This is in harmony with the physiological observation, that even when the original motor impulse passes from the nerve centre there may be produced peripheral flexion or extension according to the intensity, duration and extent of the central excitation. When we further consider that the central motor impulse is normally the effect of centripetal stimulation, we may fairly assume that the sense-stimulus, according to intensity, extensity and duration, will excite in the central substance, the motor-impulse toward flexion or extension. The stimulus which reflexly excites extension, with moderate strength and short duration, will perhaps by greater intensity or longer duration, produce flexion." [5] In Münsterberg's opinion, this explanation is in harmony with all the evidence of biology, physiology and psychology.

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[4] Beiträge zur experimentellen Psychologie. Heft 4. Lust und Unlust.

This explanation, however, is not to be taken as applying to pleasure and pain proper. Pleasure of sex (Wollust) and pain (Schmerz) are not the extremes of agreeableness and disagreeableness (Lust and Unlust), but are sensation-contents, which regularly arouse strong agreeable and disagreeable feelings. "Even if the explanation of pain and related sensations as due to peculiar trophic nerve processes or to specific nerves of feeling, is correct, still nothing is advanced, thereby, toward an explanation of the feelings of agreeableness and disagreeableness." That pain is a disagreeable sensation is a fact requiring explanation, which is to be found, not by reference to the pain-content as such, but to the reflexly excited sensations of flexion. Hence the difficulty of experimenting on this feeling in the laboratory, for in Münsterberg's words, "the sensation of pain awakens no disagreeableness as long as we know that the harmful stimulus is only produced so as to call forth this feeling as an object of study."

The physiological basis of pleasure and pain has recently been considered by another psychologist,[6] and a biological explanation attempted of the distribution of supposed nerves of pleasure and pain. Dr. Nichols' argument may be outlined as follows: "Pain is as disparate a phenomenon from pleasure as is the color blue. In the pain of the prick of a pin there is no confusion with nor passing over into pleasure. This fact of introspection is emphasized by such phenomena as floating pains, which we cannot precisely attach to some other sensation, as its quale, nor locate precisely. Further, pain may become so dominant as to usurp all other mental content; and, finally, pain has a slower rate of conduction than the sensation-content. Goldscheider has also demonstrated separate paths of conduction through the spinal cord, and has isolated specific pain nerves. These pain fibres intermingle, as shown by Goldscheider, with those of pressure, of heat, and of cold, and may be supposed to be joined also with those of taste, smell, sound and sight. Biologically, the distribution of pain nerves is intelligible, because we find them in those places on the body where pain, as a warning against dangerous contact, would be most serviceable.

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[5] Freely translated.

[6] On the Origin of Pleasure and Pain. By Herbert Nichols, Philosophical Review. Vol. I, Nos. 3 and 4.

"That no single nerve in the body will respond to pleasure, and to pleasure only, leaves the assumption of the sensational nature of pleasure without physiological demonstration. The uncertain and associative aspect of all pleasures, even those most constant in response to normal stimulation, those of eating and of sex, is quite foreign to ordinary sensation and renders it difficult for us to determine whether they are such. But we notice a distinct relation between the bodily distributions of pleasures and their functions *i. e.*, to prompt to certain actions, as was found between pains and their function as warnings. The functions of sex are the most requisite, yet the most precarious in animal life. The destiny of the race is staked upon a single act performed with great relative infrequency and difficulty. The incitement thereto should be the more unerring and sufficient. Accordingly, the pleasures of sex above all others are most instinctive and most pronouneed in intensity, in certainty, and in location. Eating is the next most vital of the sensual functions and the pleasures of eating are next in prominence. Its sensations are located just where they would be most aptly stimulated, and most surely prompt to the needed conduct. If pleasure nerves are the basis of its pleasures, they are placed just where for best service they ought to be placed. And here, as with sex, we find the strength of the pleasures proportional to the vital importance of their functions. The theory of properly distributed specific nerves of pleasure explains all this with a clearness that the rival quale-theory gives no suggestion of."[7]

In my opinion, psychology would find no difficulty in satisfactorily explaining all pleasure and pain phenomena on the basis of specialized nerves of pleasure and of pain with localized cerebral centers for each. Even the simultaneity of pleasure and pain with so many sensations is readily explained as due to association fibres between these centers and all other specific sensation centres. In the phenomena of colored audition, we have an exactly analogous persistent association between colors and sounds. There is needed some explanation of the relative infrequency of the latter association and the universality of the former. This would seem to be given by reference to the fundamental importance of pleasures and pains as stimulants to action. Whether the feeling-tone of disagreeableness or agreeableness is to be accounted for as a weak sensation of specific pleasure and pain, or as a reflexly excited sensation of movement is a question that need not here be discussed. The theories of Münsterberg and Nichols have been presented for the purpose of showing that psychology has no particular objections to offer to the physiological hypothesis of specialized nerves of pain.

In striking contrast with the intelligibility of this hypothesis are the obscurities of the physiological interpretation of the quale theory. I present Mr. Marshall's explanation of the physical basis of pleasure and pain in his own words: "Upon a superficial examination it seems natural to connect the pleasure of exercise in an organ with the efficiency of that organ, *i. e.*, with its ability to function vigorously. Pain, as involved in exercise, on the other hand, appears as similarly connected with an inefficiency in the organ—an inability to function normally in relation to the stimulus received. It will presently appear also, I think, that this position, while requiring explanation and definition of terms to bring the different pleasure-pain facts into relation, on the whole, does not present any formidable difficultie , so long as we understand it as the interpretation of pleasure and pain in connection with the action of the specific organ which is giving us the content consciousness. With a wider view of what an organ means than Aristotle, the theory may read thus: "*The activity of the organ of any content, if efficient, is pleasurable, if inefficient, painful.*" We call an action inefficient when the outcome of a certain stimulus is less that the outcome we looked for as the result of our experience. As our experience varies, so will vary our notion of inefficiency. All pleasure-pain phenomena are determined by the action in the organ concomitant of the conscious state, as related to the nutritive conditions of the organ at the time of the action. If, in any given case, the conditions as to action and nutrition remain unaltered, the pain in the main tends to increase. If the state be one of pleasure, however, the stability of the same conditions brings about decrease of the pleasure. This points to something *used up* in the case of pleasure, and the fact that there is *something to use up*, points to storage.

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[7] The account is given in Dr. Nichols' words, with some changes made necessary for condensation.

"Pleasure is experienced whenever the physical action which determines the content involves the use of stored force—the resolution of potential into actual energy; or, in other words, whenever the energy involved in the reaction to the stimulus is greater in amount than the energy of the stimulus. Pain is experienced whenever the physical action which determines the content is so related to the supply of nutriment that the energy involved in the reaction to the stimulus is less in amount than the energy of the stimulus. Pleasure and pain are primitive qualities of psychic states, which are determined by the relation between activity and capacity in the organs, the activities of which are concomitants of the psychosis."

I do not propose to criticise the details of this exposition of the physical basis of pleasure and pain. I confess that I do not understand it. I am able to form no clear conception as to what an organ of the content is nor what kind of thing this energy may be that is shunted into the organ from the external stimulus and there met by some other energy which has been stored up as the result of the processes of nutrition.

All phenomena of the body, not alone pleasure-pain phenomena, are dependent upon the use of force, and in a certain sense are phenomena of stored force. Nor has the form that the hypothesis took at the recent meeting of the American Psychological Association, that "pleasure is the use of *surplus* stored force," helped the explication. We must know *surplus over what*—the answer is, over what is necessary for efficient action, and efficient action is what experience would lead us to expect. Can we designate as scientific an hypothesis that holds it possible for a physiological process to fluctuate with variations of our expectation?

Passing details by, may not the most daring exponent of cerebral localization stand aghast at a theory that assumes pleasure and pain to be the peculiar mental correspondents of nutritive changes in the organ of the content? We are not told what the organ of the content is, but without doubt it is to be thought of as a chain or collection of ganglion-cells. In view of the fact, that we only with difficulty locate the areas for sensation groups in the cortex, that we cannot point to the location of the cells that constitute the organ of the content of any specific sensation, is it not traveling too far along the road of hypothesis to select a particular process in the ganglion-cell, as a physical basis of what Mr. Marshall considers an element of a sensation? Is not every form of consciousness dependent upon the maintenance of certain metabolic conditions in the cells that are the constituent parts of the reflex-arc of each reaction? The cell reveals other processes than those of metabolism; that just this one process of the ganglion-cell has been singled out as the physical basis of pleasure and pain, is due to certain considerations of a general nature; *i. e.*, the relation between muscular action and pleasure and pain states. This is not the method of scientific physiology. In reverse fashion, modern physiology and biology would explain the functioning of the entire organism by reference to the functions of its constituent elements. We must guard especially against this error that is so manifest throughout Mr. Marshall's exposition, of supposing that conceptions derived from an examination of the gross processes of the body or parts of the body, may be transferred for purposes of explanation to the processes of specialized cells. Mr. Marshall has shown the inconclusiveness and unscientific character of all earlier physiological interpretations of pleasure and pain on the basis of the quale doctrine. His own hypothesis is no exception to the record of failure that begins with Aristotle.

In summing up the argument of this paper, the following points may be emphasized as bearing directly upon related problems of neurology:

1. The quale-theory is open to serious objections on psychological grounds.

2. On the basis of the quale-theory, no satisfactory physiological explanation of pleasure and pain is possible—at least in the present condition of the science of physiology. Neither Marshall nor any of his predecessors has succeeded in presenting aught else than some general observations of the relations between certain gross physiological phenomena and pleasure and pain states.

3. The existence of pain centres, tracts and peripheral nerves can be brought into accord with the results of introspective psychological analysis.

4. The existence of pleasure centres, tracts and nerves, a more remote physiological hypothesis, could be interpreted with no considerable violence to current psychological conceptions.

In conclusion, the audience may be reminded that it was not the purpose of this paper to make out the strongest possible case against the quale-theory. Had it been, the most conclusive evidence would have been found in an examination of clinical data and in the results of recent experimental and pathological research. But the neurologists present are doubtless more familiar with these facts and investigations than the present speaker, and are better qualified to determine their validity and significance.

A Case of Hyperidrosis.—Dr. Federico Zavaleta, of Buenos Aires, describes a case of general hyperidrosis occurring in a man of a lymphatic-nervous temperament whose circulatory, respiratory, and digestive systems were in excellent condition. The hyperidrosis had lasted for twenty years and the least mental or physical exertion necessitated him to cease his work entirely. The perspiration is cold, skin white and anæmic, has a sensation of itching, pains at the occiput and in extremities, palpitation, an anxious feeling and highly emotional. Not being able to ascribe the state to any organic change, the author after differentiating between normal perspiration and hyperidrosis, due to changes in the nervous system, draws the following conclusions:

1. That the affection is of cerebral origin with profound functional nervous symptoms, of which the most important is the exaggerated secretion from the skin denominated hyperidrosis.

2. That in view of the inveteracy of the local and general symptoms and the serious consequences which have attended any exertion on his part, the patient is not in a physiological condition and hence unable to apply himself to his daily work. The patient was recommended as deserving of a pension on account of his previous services to the State.

Anales Del Departamento Nacional De Higiene, Buenos Aires. September, 1893. W. C. K.